

charmonium collective flows in nuclear collisions: (directed, elliptic, triangular) flows

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We employ a detailed transport model coupled with realistic hydrodynamics in heavy-ion collisions to study the anisotropic flows of charmonium, including directed flow, elliptic flow, and triangular flows. The directed flow (v_1) of J/ψ is induced by the rapidity-odd initial energy density, which arises from the rotation of the quark-gluon plasma (QGP). Meanwhile, the elliptic flow (v_2) of J/ψ primarily depends on two factors: the initial spatial energy density in the nuclear collision region and the degree of thermalization of charm kinetics. The triangular flow of J/ψ originates from the triangular flows of charm quarks, which acquire anisotropic flows from the surrounding bulk medium with fluctuating initial energy densities. These anisotropic flows (v_1, v_2, v_3) of J/ψ contribute to our understanding of the detailed evolutions of charm and charmonium in the fluctuating and rotational QGP.

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